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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Joseph H. Johnson

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EXAMINER

QUINTO, KEVIN V

ART UNIT

PAPER NUMBER

2826

DATE MAILED: 10/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/656,613	JOHNSON ET AL.	
	Examiner	Art Unit	
	Kevin Quinto	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 August 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-12, 14-19, 21-33 and 35-50 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 2-12, 14-19 and 35-50 is/are allowed.
- 6) ☒ Claim(s) 21-23 and 25-31 is/are rejected.
- 7) ☒ Claim(s) 24, 32 and 33 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 21-33 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 21, 22, and 25-31 are rejected under 35 U.S.C. 102(b) as being anticipated by Uesugi et al. (JP 2001-36069 A).
4. In reference to claim 21, Uesugi et al. (JP 2001-36069 A, hereinafter referred to as the "Uesugi" reference) discloses a structure which meets the claim. Figures 1 and 7 of Uesugi each discloses a silicon carbide based silicon structure with a single crystal silicon semiconductor material (16, 18) that is grown on a silicon carbide substrate (12, 14). The silicon carbide substrate (12, 14) is n-type. The silicon carbide substrate (12, 14) has a first dopant concentration (12 being n+ and 14 being n). The single crystal silicon semiconductor material (16, 18) is p-type (18) and n-type (16). The single crystal silicon semiconductor material (16, 18) has a second dopant concentration (18 being p and 16 being n).

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5. With regard to claim 22, the first dopant concentration (n+) of the silicon carbide substrate (12) is greater than the second dopant concentration (p or n) of the single crystal silicon semiconductor material (16, 18).

6. In reference to claim 25, the first conductivity type of the silicon carbide (12, 14) is n-type.

7. With regard to claim 26, the second conductivity type of the single crystal silicon semiconductor material (18) is p-type.

8. With regard to claim 27, the second conductivity type of the single crystal silicon semiconductor material (16) is n-type.

9. In reference to claim 28, the silicon carbide substrate includes a plurality of two silicon carbide layers. The first silicon carbide layer (12) includes a bottom surface of the silicon carbide substrate. The last second layer (14) includes a top surface of the silicon carbide substrate. In the structures of Uesugi, $k = N$. Therefore there is a "k"-th layer (14) that is n-type and has a "k"-th dopant concentration which is grown over a "k-1"-layer (12).

10. With regard to claim 29, the "k"-th silicon carbide layer (14) is grown by epitaxy (paragraph 19). Epitaxy is a chemical vapor deposition process (see Wolf, "Silicon Processing for the VLSI Era: Vol. 1 – Process Technology, p. 226). Uesugi does not disclose the use of molecular beam epitaxy to form the "k"-th silicon carbide layer.

However this places claim 29 into the form of a **product-by-process claim**:

Note that a "product by process" claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Thorpe*, 227 USPQ 964, 966; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and *In re Marosi et al.*, 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a

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"product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear. See also MPEP 2113.

Claim 29 does not distinguish over the Uesugi reference regardless of the process used to form the silicon carbide layer, because only the final product is relevant, and not the process of making such as molecular beam epitaxy.

11. In reference to claim 30, the silicon carbide substrate includes a plurality of two single crystal silicon semiconductor material layers. The first single crystal silicon semiconductor material layer (16) includes a bottom surface of the single crystal silicon semiconductor material. The last second layer (18) includes a top surface of the single crystal semiconductor material. In the structures of Uesugi, $i = M$. Therefore there is an "i"-th layer (18) that is p-type and has an "i"-th dopant concentration which is grown over an "i-1"-layer (16).

12. With regard to claim 31, the "i"-th single crystal silicon semiconductor material layer (18) is grown by epitaxy (paragraph 19). Epitaxy is a chemical vapor deposition process (see Wolf, "Silicon Processing for the VLSI Era: Vol. 1 – Process Technology, p. 226). Uesugi does not disclose the use of molecular beam epitaxy to form "i"-th single crystal silicon semiconductor material layer. However this places claim 31 into the form of a **product-by-process claim**:

Note that a "product by process" claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Thorpe*, 227 USPQ 964, 966; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and *In re Marosi et al.*, 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear. See also MPEP 2113.

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Claim 31 does not distinguish over the Uesugi reference regardless of the process used to form the "i"-th single crystal silicon semiconductor material layer, because only the final product is relevant, and not the process of making such as molecular beam epitaxy.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Uesugi et al. (JP 2001-36069 A).

15. In reference to claim 23, Uesugi does not disclose the exact first dopant concentration of the silicon carbide substrate and the exact second dopant concentration of the single crystal silicon semiconductor material as that claimed by the applicant. However:

Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Therefore, the limitation regarding the first and second dopant concentrations does not distinguish over the prior art reference of Uesugi.

Allowable Subject Matter

16. Claims 2-12, 14-19, and 35-50 are allowed.
17. Claims 24, 32, and 33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (571) 272-1920. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (571) 272-1915. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KVQ